DOCUMENT RESUME

ED 184 872 SE 030 531

TITLE Some Important Factors Predicting Mathematics Achievement Gain (1977-1978), Grades One-Six. Evaluation System Mini-Report Five.

INSTITUTION District of Columbia Public Schools, Washington, D.C. Dept. of Research and Evaluation.

PUB DATE Feb 80

NOTE 12p.

EDRS PRICE MF01/PC01 Plus Postage.

DESCRIPTORS Achievement; Elementary Education; *Elementary School Mathematics; Evaluation; *Predictive Measurement; *Predictor Variables; *Research; Testing

IDENTIFIERS *Mathematics Education Research

ABSTRACT

This is one of a series of brief and non-technical mini-reports of the Evaluation System of the District of Columbia Public Schools. This report deals with the prediction of gain in Prescriptive Mathematics Test (PMT) scores. Twenty-two variables were involved in the analyses reported in the mini-report. The data were analyzed for all grade levels, then by primary and intermediate grades. Five of the variables proved to be significant predictors of the PMT posttest score: the pretest score, grade, test level homogeneity, self-initiated reading, and percentage receiving free lunch. The all-grade-level analysis and the intermediate analysis both indicated that pretest score, grade, and test level homogeneity were significant predictors. (MK)

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DISTRICT OF COLUMBIA PUBLIC SCHOOLS

THE EVALUATION SYSTEM

SOME IMPORTANT FACTORS PREDICTING MATHEMATICS ACHIEVEMENT GAINS (1977-1978) GRADES ONE - SIX

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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MINI-REPORT FIVE

VINCENT E. REED
SUPERINTENDENT OF SCHOOLS
FEBRUARY 1980

SE 030 531

DISTRICT OF COLUMBIA PUBLIC SCHOOLS

SOME IMPORTANT FACTORS PREDICTING MATHEMATICS ACHIEVEMENT GAIN

(1977 - 1978)

GRADES ONE-SIX

Evaluation System Mini-Report Five

Evaluation System

Division of Research and Evaluation

Office for Educational Accountability

February 1980

MAR 1 4 1980

District of Columbia Public Schools

OFFICE OF THE SUPERINTENDENT

Superintendent of Schools	Vincent E. Reed
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OFFICE FOR EDUCATIONAL ACCOUNTABILITY

Associate Superintendent	Wilbur A. Millard

DIVISION OF RESEARCH AND EVALUATION

Assistant Superintendent	Mildred P. Cooper
Director, Evaluation System	Herman Cobb, Jr.
Assistant Director	Beulah G. Glenn

. . . . . .

Consultant	Barry D. Smith

Preface

This is one of a series of mini-reports of the Evaluation System. The Evaluation System publishes a major report of evaluations and findings for each year of data collected. It also does a variety of background analyses and special studies of the data. Those analyses and studies are of specific technical and practical questions and issues. Whenever an analysis or a study of general interest has been completed, the Evaluation System will make the results available in this mini-report form.

Mini-reports are intended to be brief and non-technical. When they deal with technical material, the supporting analyses can be obtained from the Division of Research and Evaluation. In general, a formal technical report containing full documentation and data for the mini-series will be published periodically.

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INTRODUCTION

The Evaluation System has thus far focused primarily on reading achievement gain in an effort to determine what variables contribute significantly to gain and what kinds of reading programs are most effective. The System will continue to report on reading achievement. However, it is now possible, in addition, to analyze achievement gains in mathematics as well. One previous mini-report (No. 4) has dealt with Prescriptive Mathematics Test (PMT) data, providing basic benchmark statistics. The present report deals with the prediction of gain in PMT scores using data for the 1977-78 school year. Comparable data are not available for previous years, but will be for future years.

The Data Base

The data for the present analyses were drawn from the 1977-78 Evaluation System data set contained in the Evaluation Data Acquisition, Control, and Analysis (EDACA) System. The total pool of classes for the 34 elementary schools in the evaluation system in 1977-78 was 548. That is an average of 16 classes per school or an average of 91 per grade level if only 6 grades are considered. For purposes of the analyses reported here, the usable sample of classes across the all six grades was 372. Of these, 190 were primary grade classes, while 182 were intermediate grade classes. A full description of the data base is available in the Evaluation System report: Evaluation of Outcomes 1977-78: An Evaluation System Report on Reading Programs and Reading Achievements. Part II - A Technical Report, dated November 1979 Data collection procedures and forms are also described.

Variables

A total of 22 variables were involved in the analyses reported here. Briefly, the variables were:

1. PMT Posttest score
2. PMT Pretest score
3. Grade
4. Number of PMT test levels
5. Percentage of students
6. Teacher absence rate
7. Teacher turnover rate
8. Class size
9. Percentage of male students
10. Class holding rate
11. Average reading material level
12. Average interest in reading
13. Average need for extra help in reading
14. Percent receiving extra help
15. Presence of math specialist
16. Teaching situation - team teaching
17. Teaching situation - open space
18. Learning problems - reading
19. Learning problems - behavior
20. Learning problems - health
21. Reading material level - standard deviation
22. Average amount of reading on own

These variables are predominately the same ones employed in analyses of PRT reading data presented in earlier reports. The principal exceptions are variables 1, 2, and 4 above. Variables 1 and 2 are the PMT pretest and posttest scores. These, of course, are simply the mathematics test scores which replace the reading test scores used in earlier reports. Like the PRT, the PMT has multiple levels, and variable 4 above is the number of levels of PMT tests used in a given class. Previous analyses of reading data have included the number of levels of PRT test used.

RESULTS

Analyses

As in earlier analyses of reading achievement, classes were analyzed as units, using class means. The posttest math score (class average percentage of math objectives mastered in the spring) was used as the criterion for mathematics performance. This criterion variable is listed as variable 1 above. A series of regression analyses were run to determine what factors in the school settings or in the behavior or background of the classes would help us to significantly predict the posttest scores.

That is, what factors are important contributors to math performance in classes? A series of three regression analyses, with posttest score as the criterion, were run. Each examined the effect of 21 potential contributing variables (numbers 2 - 22 in the list). The first analysis examined the effects of these variables across all six grades involved in the study. The second and third regression analyses involved, respectively, the primary grades (grades 1-3) and the intermediate grades (4-6) separately. The effects of pretest mathematics performance (variable 2) and grade level (variable 3) were statistically controlled in order to examine the effects of other potentially important variables on the math score.

The All-Grades Analysis

Results of analyses involving data for all six grades indicated the presence of three significant predictors of the PMT posttest score:

1. Pretest Score. The PMT math pretest score, entered as a control variable, significantly predicted the posttest score, as would be expected. This is consistent with our experience with reading score relationships.

2. Grade. The grade level of the class was also significantly predictive of posttest scores. Again the grade variable was entered primarily as a control.

3. Test Level Homogeneity. The third significant predictor of PMT posttest scores was the number of levels of the test represented in any given class. Results indicated, specifically, that having a small number of test levels present is predictive of higher posttest scores. The number of different levels of the PMT test used in a given class is an indication of the range of the individual math skills of students in the class. Thus, results suggest that classes with the narrower ranges have higher year-end performance scores even when grade and pretest have been

controlled. One explanation might be that teachers in such classes have more time to spend on individual skill development.

Primary Grades

The separate regression analysis of primary grades revealed the presence of five significant predictors of the PMT posttest score:

1. The PMT Pretest Score.

2. Grade.

3. Test Level Homogeneity. Again, as in the analysis of all six grades, classes having a smaller number of test levels had higher posttest scores.

4. Self-Initiated Reading. Interestingly enough, results showed that children who engage in more reading on their own time while in school have higher math posttest scores. That is, self-initiated reading is predictive of better mathematics performance. This result is perhaps not as surprising as it might first appear. What it may suggest is that students who are interested enough in school to self-initiate reading are probably also likely to show more interest in and attention to other academic pursuits, such as mathematics. Thus, interest in the subject matter and in school more generally is an important contributor to the learning process. This may be an important finding, since it is an area in which the school system can potentially intervene. Teachers can be informed of this finding and trained and encouraged to do everything possible to stimulate geniune interest in their pupils. In addition, educational materials for the classroom can be purchased with the knowledge that having materials that are maximally interesting to students may significantly enhance their achievement levels. Finally, parents can be informed of the importance of interest as a factor in the learning process and shown ways in which they can stimulate and encourage the interest of their child in school subjects.

5. Percentage Receiving Free Lunch. The final significant predictor was the percentage of students in a given class receiving free lunch, and results indicated specifically that classes with higher percentages of free lunch students have lower math posttest scores. This variable can be taken as a rough indicator of the socio-economic index of the class, and results thus indicate that higher socio-economic level is predictive of better mathematics performance.

Intermediate Grades

Results of the analysis of intermediate grades revealed significance of the same three variables that were significant in the all-grades analysis.

CONCLUSIONS

It is clear that the variables available in the present data base are somewhat more capable of predicting math scores in the primary grades than in the intermediate grades. Thus, in the primary grades both socio-economic level and self-initiated reading (probably indicative of interest) are significant predictors of math performance. In addition, at both primary and intermediate grades, homogeneity of math test levels in any given class is predictive of higher math posttest performance. This last variable may be of considerable importance, since it suggests an approach to the assigning of students, at least with regard to incoming skills in mathematics. Specifically, narrowing the skill range is indicated by present results.

Despite the statistically significant and interesting results reported here, particularly with regard to homogeneity of test level and self-initiated reading or interest, a word of caution is in order. The 1977-78 data base represents our first opportunity to examine mathe-

matics data within the Evaluation System. As with reading data, these results should be cross-validated and extended. It is anticipated that similar PMT data will be available in the 1978-79 data base which will shortly come into the EDACA System. Cross-validation can then be undertaken.